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UNITED STATES DEPARTMENT OF AGRICULTURE
WAR FOOD ADMINISTRATION
Office of Marketing Services
Washington, D. C.

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April 1945

A QUICK TEST FOR FLOUR OR BREAD ENRICHMENT

By Louis Feinstein, Chemist

A quick test, by means of which it is possible to distinguish promptly between adequately enriched, partially enriched, and unenriched white flour or bread, has been developed by the Grain Products Branch, Office of Marketing Services, War Food Administration. The test is a qualitative and semi-quantitative test designed to detect the presence and estimate the quantity of niacin or its amide in white flour or white bread.

Since the four required ingredients for enriching flour or bread (thiamine, riboflavin, niacin, and iron) are ordinarily added in the form of a "premix" or tablet containing these ingredients in the proper proportions, a test for any one of these ingredients usually indicates whether or not the product is properly enriched in respect to all of the required ingredients. Positive proof of proper enrichment, of course, must be based on actual assay for all four enrichment ingredients.

Principle of the Test

The test is based on the König reaction ^{1/} in which pyridine compounds (including niacin and niacinamide) react with primary or secondary amines and cyanogen bromide to produce complex colored compounds.

Reagents

BOTH REAGENTS USED ARE POISONOUS AND SHOULD BE USED WITH CARE. They should be used only in a well-ventilated room and should not come in contact with the skin.

1. Aniline Solution — Add sufficient 95 percent ethyl alcohol to 4 grams of redistilled aniline to make 100 milliliters of solution.
2. Cyanogen Bromide Solution (Made either by (a) or (b)):
 - (a) Water saturated with bromine at 5° to 10° C. is just decolorized in the cold by the slow addition of a 10 percent potassium cyanide or sodium cyanide solution. The resulting solution contains approximately 4 percent of cyanogen bromide. During this process the temperature of the mixture must be kept below 10° C.
 - (b) Four grams of Cyanogen Bromide Crystals (Eastman Kodak Chemicals, No. 919) are dissolved in sufficient water to make 100 milliliters of solution.

^{1/} König, W. J. Prakt. Chem., Vol. 69, p. 105 (1904); Vol. 70, p. 19 (1904).

Procedure

1. Preparation of sample.

(a) Flour:

Place approximately 0.5 to 1 gram of flour on white blotting paper and press the flour flat so that the packed flour is about 3 mm. thick, or press the flour into the well of a porcelain indicator block.

(b) Bread:

No preparation is necessary. A single slice of bread or several slices from the same loaf may be used in the test.

2. Color development.

Drop 2 drops of the aniline solution onto the center of the flattened flour or slice of bread causing a wetted portion about 6 mm. in diameter. Drop onto this wetted portion 3 drops of the cyanogen bromide solution. Almost immediately a canary yellow color appears if the flour or bread contains free niacin or niacinamide.

3. Estimation of degree of enrichment.

The depth of color produced depends on the amount of niacin or niacinamide present. A simple comparison with similarly treated flour or bread of known degree of enrichment may be used to judge the degree of enrichment of the treated samples under test. The comparison should be made 4 minutes after the addition of the reagents. Unenriched flour or bread may develop a slightly yellow color only after 10 or 15 minutes, probably because the small amount of niacin naturally present in unenriched flour is chemically bound in some manner and is gradually liberated by the reagents used. Enriched flour and bread, however, contain a relatively large amount of niacin (or its amide) which is in the free state because it has been added as such in the enriching process.

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